COMPARISON OF THE IMMEDIATE EFFECT OF DIFFERENT TYPES OF TRUNK EXERCISE ON THE STAR EXCURSION BALANCE TEST IN MALE ADOLESCENT SOCCER PLAYERS -AN EXPERIMENTAL STUDY

A Dissertation submitted to

THE TAMIL NADU DR. M.G.R. MEDICAL UNIVERSITY, CHENNAI

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MASTER OF PHYSIOTHERAPY DEGREE

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Submitted by

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NANDHA COLLEGE OF PHYSIOTHERAPY

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CERTIFICATE

This is to certify that the dissertation entitle "COMPARISON OF THE IMMEDIATE EFFECT OF DIFFERENT TYPES OF TRUNK EXERCISE ON THE STAR EXCURSION BALANCE TEST IN MALE ADOLESCENT SOCCER PLAYERS" is a bonafide research work done by Mr. SHERIN JOHNSON in partial fulfillment of the requirement for the degree of MASTER OF PHYSIOTHERAPY (SPORTS PHYSIOTHERAPY).

Evaluated on .....

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Place: Erode **Guide Signature**

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CONTENTS

CHAPTER – I

INTRODUCTION

Balance refers to an individual's ability to maintain their line of gravity within their Base of support (BOS). It can also be described as the ability to maintain equilibrium, where equilibrium can be defined as any condition in which all acting forces are cancelled by each other resulting in a stable balanced system. There are two types of balances:

Static Balance: It is the ability to maintain the body in some fixed posture. Static balance is the ability to maintain postural stability and orientation with centre of mass over the base of support and body at rest

Dynamic Balance: Dynamic balance is the ability to transfer the vertical projection of the centre of gravity around the supporting base of support. Dynamic balance is the ability to maintain postural stability and orientation with centre of mass over the base of support while the body parts are in motion.

Trunk stability is important for the connection of movements between the lower and upper body, as well as the control of body balance and movements.

In the current study trunk was defined as the region of the low back and pelvis, and trunk stability was considered as the ability to control the position and motion of the trunk during dynamic loading and movement conditions. In order to maintain optimal trunk stability, coordination and co-activation neural control of trunk muscles are needed.

Trunk muscles are classified as global and local muscles depending on its anatomical position and orientation. Local muscles directly or indirectly attached to the lumbar vertebrae are associated with segmental stability of the lumbar spine. On other hand, global muscles attached to hips and pelvis are related to torque production and transfer of load between thoracic cage and pelvis.

Trunk exercises are often performed to improve sports performance and strength, prevent injuries and rehabilitate patients with low back pain and dysfunction. One type of trunk exercises, described as conventional exercise(CE) include repeated flexion and extension of the trunk, such as sit -ups or back extension, and are performed to strengthen the trunk muscle, and are performed to strengthen the trunk muscle.

Another type of trunk exercise described as trunk stabilisation exercise (SE) keep the lumbar spine in a neutral position accompanying trunk movements, such as back bridge. The main aim of the SE is to restore and improve the coordination and co contraction of global and local muscles.

Previous studies have demonstrated that SE improved trunk stability and athletic performance, and prevent low back pain. Recently several research have SE improve static and dynamic balance.
It is not known how much the SE contribute to improving physiological responses, performance, and static and dynamic balance and preventing injuries because there have been very few studies that investigated the immediate effects of the SE alone.

Kaji et al23 reported that the SE program immediately improved static balance. Imai et al.24 compared the immediate effect of the SE on static balance with that of the CE. They found that static balance improved immediately with SE but did not improve with the CE. This result indicates that the effect of training on static balance varies depending on the types of trunk exercises and that the immediate improvement of static balance is a specific effect of the SE.

Imai et al15 and Kahle et al13 previously reported that dynamic balance was improved by a 12-week and 6-week SE program, respectively. However, the immediate effect of SE or CE on dynamic balance is not yet known because of the lack of evidence related to the immediate effect of trunk exercises.

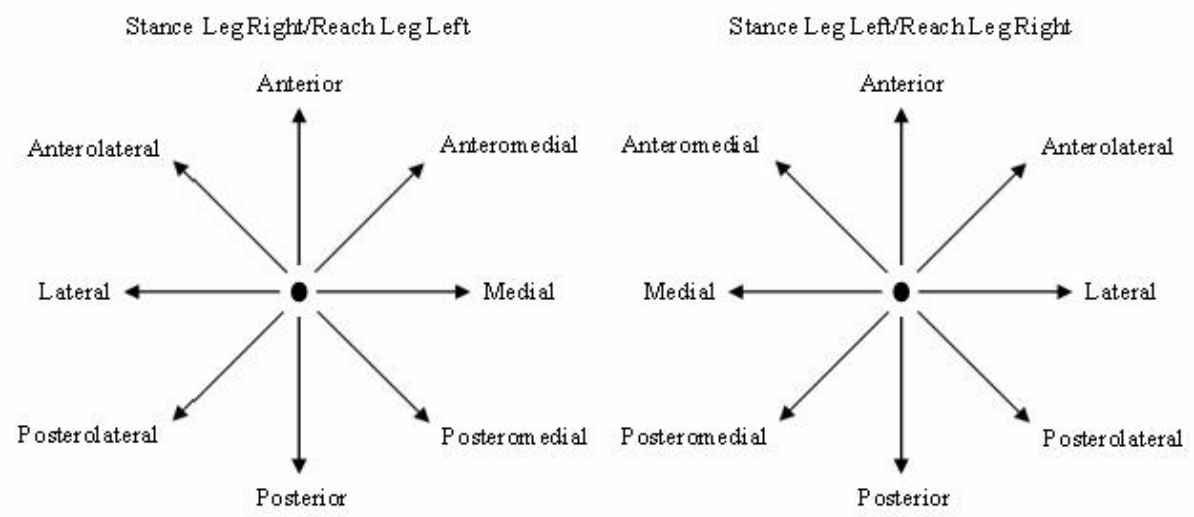
The **Star Excursion Balance Test (SEBT)** is a dynamic test that requires strength, flexibility, and proprioception. It is a measure of dynamic balance that provides a significant challenge to athletes and people who are physically active. The test can be used to assess physical performance but can also be used to screen deficits in dynamic postural control due to musculoskeletal injuries like chronic ankle instability. It could be used to identify athletes at greater risk for lower extremity injury. It is also possible to use the test during the rehabilitation of orthopedic injuries in healthy physically active adults.

The SEBT could be used to compare balance ability among different sports and to assess physical performance. Research have suggested to use the SEBT as a screening tool for sport participation on the one hand and as a post-rehabilitation test to ensure dynamic functional symmetry on the other hand. It's also been showed that the performance of SEBT improves after training.

You need to use 4 strips of athletic tape with a length of 6-8 foot. Then you should form a '+'. After this is done, you have to use 4 strips of athletic tape of the same length but this time you are going to form an 'x'. It is important that all the different lines are separated from each other by an angle of 45°

The goal of the SEBT is to maintain single leg stance on one leg while reaching as far as possible with the contra lateral leg . The person performing this test must maintain a base of support on one leg, while using the other leg to reach as far as possible in 8 different directions. This person (standing on his left leg for example) must reach in 8 different positions, once in every of the following directions: anterior, anteromedial, medial, posteromedial, posterior, posterolateral, lateral and anterolateral. The anterior, posteromedial and posterolateral directions appear to be important to identification individuals with chronic ankle instability and athletes at greater risk of lower extremity injury.

It is important, that the test capture the greatest amount of information of instability in the shortest amount of time. When the person demonstrates a significantly decreased reach while standing on the injured limb compared to standing on the healthy limb, the Star Excursion Balance Test has shown his ability to point out a loss of dynamic postural control.



Therefore this study compares the immediate effect of stabilisation exercise with that of conventional exercise on dynamic balance.

1.1 NEED FOR STUDY

Good lower extremity balance and neuromuscular control are important factors contributing to the improved performance and reduced risk of injury among adolescent soccer players. It has been demonstrated that many athletes are at risk of lower extremity injuries because of the poor trunk stability and strength. Trunk exercises are done to improve static and dynamic balance. A few studies have demonstrated immediate effects of conventional exercises and stabilisation exercise on static balance. Thus,

need for this study is to identify and compare the immediate effects of conventional exercises and stabilization exercises on star excursion balance test, which is a measure of dynamic balance.

1.2 AIM OF THE STUDY

Aim of the study is to compare the immediate effects of trunk exercise on star excursion balance test in male adolescent soccer players

1.3 OBJECTIVE OF THE STUDY

- To determine the immediate effect of conventional exercises on star excursion balance test among adolescent soccer players.
- To determine the immediate effect of stabilisation exercises on star excursion balance test among adolescent soccer players
- To compare and contrast the immediate effect of conventional and stabilisation exercises on star excursion balance test among adolescent soccer players

1.4 STATEMENT OF THE PROBLEM

"**Comparison of the immediate effect of different types of trunk exercises on the star excursion balance test in male adolescent soccer players**."

1.5 HYPOTHESIS

- **Null Hypothesis**

Based on review of literature the null hypothesis is stated as **"There won't be any significant immediate effect for conventional exercise and stabilisation exercise on star excursion balance test among male adolescent soccer players."**

- **Alternative Hypothesis**

The alternative hypothesis is **"There will be a significant immediate effect for conventional exercise and stabilisation exercise on star excursion balance test among male adolescent soccer players."**

1.6 EXPECTED OUTCOME

Performing stabilisation exercises will bring out remarkable immediate effect on star excursion balance test among male adolescent soccer players.

CHAPTER – II

REVIEW OF LITERATURE

- **Mills JD, Taunton JE, Mills WA ,(2005)**recently, started to use a novel test to evaluate the trunk function in patients with musculoskeletal disease in the lower extremities. The test involved a body righting movement while sitting on the bed, thus named the "trunk righting test" (TRT). The aim of this study is to investigate whether TRT is a reproducible and reliable test for the observers, independent of their experience.The intraexaminer intraclass correlation coefficient showed that the reproducibility was higher than the standard of 0.90, confirming that the test could be performed with excellent reproducibility within the same examiners. Furthermore, the interclass correlation coefficient was also as high at 0.93, revealing that the interobserver reproducibility is also high. There was no statistically significant difference between the therapists with different levels of experience. The results suggest that the test is simple and reproducible even for inexperienced therapists, and that the TRT could be used in the clinic, independent of the experience of the therapists**.**

- **Jamison et al.,(2012),** done a study on Randomized controlled trial of the effects of a trunk stabilization program on trunk control and knee loadinand found that Quasistatic TS exercises did not improve core strength, trunk control, or knee loading relative to RT potentially because of a lack of exercises, including unexpected perturbations and dynamic movement. Together, these results suggest the potential importance of targeted trunk control training to address these known anterior cruciate ligament injury risk factors.

- **Panjabi M M,(1992),**The neutral zone appears to be a clinically important measure of spinal stability function. It may increase with injury to the spinal column or with weakness of the muscles, which in turn may result in spinal instability or a low-back problem. It may decrease, and may be brought within the physiological limits, by osteophyte formation, surgical fixation/fusion, and muscle strengthening. The spinal stabilizing system adjusts so that the neutral zone remains within certain physiological thresholds to avoid clinical instability**.**

- **Bergmark A .,(1989),**states that the lack of knowledge implies great difficulties at numerical simulation of equilibrium states of the spinal system. These difficulties remain even if considerable reductions are

made, such as the assumption that the thoracic cage behaves like a rigid body. A particularly useful point of view about the main principles of the force distributions appears to be the distinction between a local and a global system of muscles engaged in the equilibrium of the lumbar spine. The local system consists of muscles with insertion or origin (or both) at lumbar vertebrae, whereas the global system consists of muscles with origin on the pelvis and insertions on the thoracic cage. Given the posture of the lumbar spine, the force distribution over the local system appears to be essentially independent of the outer load of the body (though the force magnitudes are, of course, dependent on the magnitude of this load). Instead different distributions of the outer load on the body are met by different distributions of the forces in the global system. Thus, roughly speaking, the global system appears to take care of different distributions of outer forces on the body, whereas the local system performs an action, which is essentially locally determined (i.e. by the posture of the lumbar spine). The present work focuses on the upright standing posture with different degree of lumbar lordosis**.**

- **Thomas TR, Ridder MB.,(1989)** , compare the effects of different abdominal exercise programs on abdominal muscular function and physique. Forty-five men and women (aged 18-26 yr) were randomly

assigned to training using: (1) abdominal crunch (AC) weight machine; (2) steated incline (SI) weight machine; or (3) incline sit-up (ISU) exercise. Strength training occurred three times per week for 10 weeks. All groups improved in abdominal muscular strength and endurance. The ISU and AC group improved in muscular power (timed sit-up), while flexibility was maintained or increased in all groups. Abdominal skinfolds tended to increase and girths generally were unaltered by the abdominal exercise programs. These results suggest that abdominal weight machines or traditional incline sit-ups are effective in altering abdominal muscular function, but local abdominal exercise alone is unsatisfactory for reducing stomach skinfolds or girth**s.**

- **Hodges PW.,(2003),** core stability exercise is an evolving process, and refinement of the clinical rehabilitation strategies is ongoing. Two major foci are addressed in contemporary core stability programs: motor control and muscle capacity. Both of these factors have considerable foundation in the literature and can be seen as a progression of exercise rather than conflicting approaches. Importantly, the clinical efficacy of these approaches is being realized in clinical trials.

- **Durall CJ, Udermann BE, Johansen DR et al. ,(2009),**These data suggest that training the trunk musculature twice per week during a 10-week period with a relatively simple floor exercise protocol was an effective stimulus to improve trunk endurance measures. It is encouraging that none of the gymnasts reported new episodes of LBP during the subsequent competitive gymnastics seaso**n.**

- **Sato K, Mokha M,(2009) ,**conducted a study to identify the effectiveness of core strength training (CST) on improving athletic performance. The aim of this study was to determine the effects of 6 weeks of CST on ground reaction forces (GRFs), stability of the lower extremity, and overall running performance in recreational and competitive runners. After a screening process, 28 healthy adults (age, 36.9 ± 9.4 years; height, 168.4 ± 9.6 cm; mass, 70.1 ± 15.3 kg) volunteered and were divided randomly into 2 groups (*n* = 14 in each group). A test-retest design was used to assess the differences between CST (experimental) and no CST (control) on GRF measures, lower-extremity stability scores, and running performance. The GRF variables were determined by calculating peak impact, active vertical GRFs (vGRFs), and duration of the 2 horizontal GRFs (hGRFs), as measured while running across a force plate. Lower-extremity stability

was assessed using the Star Excursion Balance Test. Running performance was determined by 5000-m run time measured on outdoor tracks. Six 2 (pre, post) × 2 (CST, control) mixed-design analyses of variance were used to determine the influence of CST on each dependent variable, $p< 0.05$. Twenty subjects completed the study ($n_{exp} = 12$ and $n_{con} = 8$). A significant interaction occurred, with the CST group showing faster times in the 5000-m run after 6 weeks. However, CST did not significantly influence GRF variables and lower-leg stability. Core strength training may be an effective training method for improving**.**

- **Hides JA, Jull GA, Richardson C.,(2001),** found from their study that Long-term results suggest that specific stabilisation exercise therapy in addition to medical management and resumption of normal activity may be more effective in reducing low back pain recurrences than medical management and normal activity alone. .

- **Robinson and Gribble** (2009)demonstrated that, in most reach directions, the maximum reaching distances and associated kinematic displacement values of the stance limb stabilized by the fourth trial. Thus, they recommended that only 4 practice trials need to be

performed before measuring reaching distances for clinical or research purposes.

- **Parkhouse KL, Ball N.,(2011),**undertaken a study on influence of dynamic versus static core exercises on performance in field based fitness tests. Findings indicate that both types of training improved specific measures of core stability but did not transfer into any sport-related skill**.**

- **Akuthota V, Ferreiro A, Moore T, et al.,(2008)**Core stability is essential for proper load balance within the spine, pelvis, and kinetic chain. Abdominal, gluteal, hip girdle, paraspinal, and other muscles work in concert to provide spinal stability. Core stability and its motor control have been shown to be imperative for initiation of functional limb movements, as needed in athletics. Sports medicine practitioners use core strengthening techniques to improve performance and prevent injury. Core strengthening, often called lumbar stabilization, also has been used as a therapeutic exercise treatment regimen for low back pain condition**s.**

- **Waldén M, Atroshi I, Magnusson H, et al.,(2011)**, A neuromuscular warm-up programme significantly reduced the rate of anterior cruciate ligament injury in adolescent female football players. However, the absolute rate difference did not reach statistical significance, possibly owing to the small number of events..

- **Sato K, Mokha M. (2011)** done a study 'Does core strength training influence running kinetics, lower-extremity stability, and 5000-M performance in runners?'.They found thata significant interaction occurred, with the CST group showing faster times in the 5000-m run after 6 weeks. However, CST did not significantly influence GRF variables and lower-leg stability. Core strength training may be an effective training method for improving performance in runners.
- **Sharma A, Geovinson SG, Singh Sandhu J (2012)** states that nine-week strategic core strengthening exercise program increases trunk stability and in turn improves block difference (vertical jump parameter).

- **Childs JD, Teyhen DS, Casey PR, et al(2010)** suggest that exercise programs that target core lumbar musculature may offer no additional preventative benefit when compared to traditional lumbar exercise programs. Also, brief psychosocial education may be an important adjunct to exercise programs as they may prevent the seeking of health care when experiencing LBP.

- **Plisky PJ, Rauh MJ, Kaminski TW, et al. (2006)** found components of the SEBT to be reliable and predictive measures of lower extremity injury in high school basketball players. Our results suggest that the SEBT can be incorporated into preparticipation physical examinations to identify basketball players who are at increased risk for injury**.**

- **Filipa A, Byrnes R, Paterno MV, et al (2010**)Female soccer players demonstrated an improved performance on the SEBT after Neuromuscular training programme that focused on core stability and lower extremity strength**..**

CHAPTER III

MATERIALS AND METHODOLOGY

3.1 STUDY DESIGN

Cross over experimental study was used.

3.2 STUDY SETTING

This study was carried out in Nandha soccer club , Nandha Outpatient Department Erode.

3.3 STUDY DURATION

Total duration of study was 6 months.

Treatment duration was 3 weeks.

3.4 SAMPLING METHOD

Sample was collected by convenient sampling method.

3.5 STUDY POPULATION AND SAMPLING

Sampling size – 11 Adolescent male soccer players

4 players SE, CE and NE

4 players CE, NE and SE

3 players NE, SE and CE

3.6 CRIETERIA FOR SAMPLE SELECTION

INCLUSION CRIETERIA

- Male soccer players in adolescent age group (10-19years).
- Those attending school soccer practice or games 6 times per week

- No cerebral concussions
- No vestibular disorders
- No upper respiratory or ear infections

EXCLUSION CRIETERIA

- Soccer players of age less than 10 years and more than 19 years
- Female athletes
- History of back pain within one year
- History of lower extremity injury within one year

3.7 MATERIALS USED

- Sticking Tape
- Measuring tape
- Pencil

3.8 PROCEDURE

Thirty adolescent male soccer players participated in this study. Their mean ± SD age, height, and body mass were 17.9 ± 0.3 years, 168.5 ± 5.4 cm, and 60.1 ±5.1 kg, respectively. The study was comprised of pretest, interventions and post testing.

Prior to pre testing preparation sessions involving the demonstration and practice of testing was held once for all participants to get familiarised with testing procedures. Players performed stabilisation exercise and conventional exercise after pre testing for 5 minutes.

In the non exercise condition participants sat and rested on a chair for 5 minutes. All the demonstration programmes were taught by researcher's demonstrations. All the participants performed same soccer practice during the training period of study. During the period of trunk exercise programmes participants were instructed not to do any additional physical training on an individual basis. Post testing was conducted after intervention period.

For performing star excursion balance test, floor is marked with a star pattern in 8 directions: 45^0apart from each other: anterior, posterior, medial, lateral, posterolateral, posteromedial ,anterolateral and anteromedial. One foot is placed in the middle of the star pattern. The subjects performed SEBT in the anterior, posteromedial and posterolateral directions. Their hands were placed on iliac crest during each test.

The subject makes a light tap on the floor, and returns the leg to the centre of the star. The distance from the centre of the star to the tap is measured. The trial is nullified and has to be repeated if the subject commits any of the following errors: makes a heavy touch, rests the foot on the ground, loses balance, or cannot return to the starting position under control.

The longest reach distance in each direction was noted. For accurate analysis the data of reach distance was normalised by leg length to exclude the influence of leg length. The leg length were measured from the most distal end of the anterior superior iliac spine to the most distal end of the lateral malleolus on each limb.

3.9. STATICAL TOOLS

Statistical analyses were performed by using the software SPSS for Mac Ver. 19 (SPSS Inc. Chicaco,IL,USA). The test-retest reliability for the SEBT was calculated by using a two-way random effect model intraclass correlation coefficients (ICCs). The baseline data of the SEBT between groups were compared by using a one-way ANOVA. A two-way (group x time) repeated-measures ANOVA with a mixed-model design design was used to assess the changes over time and the between-group difference

CHAPTER – IV

DATA ANALSIS & INTERPRETATION

The test-retest reliability analysis demonstrated ICCs of 0.965, 0.888, and 0.948 for the anterior, posterolateral, and posteromedial directions, respectively. There were no significant differences between groups at the baseline data of each direction ($p > 0.05$). For the SEBT composite score, significant condition-by-time interactions existed ($F = 5.441$, $p = 0.010$). A Bonferroni post hoc test detected that the SEBT composite score was increased significantly only after the SE ($p < 0.001$, ES = 0.53). A moderate ES (0.53) was associated with this relation. The composite score did not change after the CE ($p = 0.097$, ES = 0.15) and NE ($p = 0.570$, ES = 0.06) (Table 1).

Table:1. The results of normalized composite score of the star excursion Balance Test

	Pre	Post	Bonferroni	% Change	ES
Composite					
SE	94.0 ± 4.8	96.8 ± 5.7	0.000	2.9	0.53
CE	94.7 ± 6.1	95.6 ± 6.5	0.097	1.0	0.15
NE	95.1 ± 5.1	95.4 ± 5.1	0.570	0.3	0.06

In the analysis of each direction, there were significant condition-by-time interactions in the posterolateral direction ($F = 5.764$, $p = 0.008$) and posteromedial direction ($F = 7.745$, $p = 0.002$). However, no interaction effect in the anterior direction was noted ($F = 0.116$, $p = 0.891$). In the SE condition, the Bonferroni post hoc test revealed that the SEBT score of the posterolateral direction ($p = 0.002$, ES = 0.44) and posteromedial direction ($p < 0.001$, ES = 0.74) was significantly greater at the posttest than at the pretest (Table 2). Small to moderate ESs were associated with these relations.

Table:2. The results of normalized reach distance scores of each direction of the star Excursion Balance Test					
Direction	Pre*	Post*	Bonferroni	% Change	ES
Anterior					
SE	74.0 ± 3.4	73.7 ± 4.6		-0.4	0.07
CE	75.0 ± 6.0	74.9 ± 5.1		0.1	0.01
NE	73.3 ± 5.3	73.5 ± 4.8		0.3	0.04
Posterolateral					
SE	102.8 ± 7.3	106.2 ± 8.1	0.002	3.3	0.44
CE	103.6 ± 6.8	105.2 ± 8.1	0.115	1.5	0.21
NE	105.4 ± 7.4	104.1 ± 7.8	0.191	-1.3	0.17
Posteromedial					
SE	105.3 ± 5.8	109.8 ± 6.4	0.000	4.3	0.74
CE	105.5 ± 7.6	106.2 ± 8.2	0.403	0.6	0.08
NE	106.6 ± 4.9	108.0 ± 4.4	0.077	1.3	0.29

CHAPTER – V

RESULT AND DISCUSSION

This study compared the immediate effects of different types of trunk exercises on the performance on the SEBT. One interesting finding was that the SEBT composite score significantly improved only after the SE but not after the CE and NE. Thus, the results indicate that the SE has the immediate effects concerning improvement of dynamic balance.

Although previous studies have demonstrated that 12 weeks and 6 weeks of the SE improved dynamic balance,13,15 the current research provides the first evidence showing the immediate effects of the SE on dynamic balance. Concerning the reach direction, results show that the reach distance improved in the posteromedial and

posterolateral directions and that in the anterior direction did not change. For the posterior directions, the hip flexion range of motion of the stance leg is important. 38 Because the trunk is leaning forward to maintain balance in the SEBT position,39 eccentric muscle contraction of the hamstrings and low back muscles, such as the erector spinae and multifidus, is needed.40 Thus, the function of the local muscles as monitors and the control of the trunk motion by the global muscles are both important. During the SE program prescribed here, the trunk position was maintained and adjusted by working the local and global muscles.37 Therefore participants might have improved

the control of the trunk position during the posterior directions of the SEBT after the SE.

The SE involving arm and leg lifts used in this study have previously been shown to involve high external oblique activity, which is likely to assist in control of trunk rotation.37 Thus, the improvement in the control of the trunk rotation may help the control of the lower extremity during the posteromedial direction of the SEBT.

In contrast, the anterior direction was not changed significantly. This supported the findings of the previous study that investigated the effect over 8 weeks of training.29 Hock et al32 reported that the range of motion of the dorsiflexion influenced the anterior direction to a greater degree than posterior directions. Therefore, it is possible that the anterior direction is more sensitive to changes affected by the distal contributions.

Although the SE program was effective in improving the SEBT, no change was found after the CE program. The SE differs from the CE in terms of the stresses applied on particular body segments. Some basic principles of physical training must be followed to obtain the optimal effects of physical training.41 The specific adaptation to imposed demands (SAID) is one such basic principle. The SAID principle states that the human body will adapt specifically in response to the demands and stresses placed on it.41 The SE program consists of closed kinetic chain positions that place

unilateral stresses on the hip extensors, and the task of movement is to maintain and control these positions.

This stress resembles the stress of the SEBT in the posteromedial and posterolateral directions. On the other hand, the CE applies stress to the lumbar spine flexors and extensors in a dynamic bilateral manner. Therefore, the SE may be more suitable than the CE in terms of SAID as a training program to improve dynamic balance.

LIMITATIONS OF THE STUDY

- Sample size was small
- All participants were male adolescent soccer players
- The effect of only few trunk exercises were studied
- This study could not explain how long the immediate effect on SEBT lasts
- There were nocontrol groups in this study

RECCOMMENDATIONS FOR FUTURE STUDY

- Sample size can be increased
- Soccer players of different age groups can be included
- Duration of the study can be extended
- More trunk exercises can be included to find out the effect of those on SEBT

CONCLUSION

The study demonstrated that the posteromedial and the posterolateral directions of the SEBT were improved immediately after stabilisation exercise,but not after CE. Results of this study suggests that stabilisation exercise programmes used in this has immediate effect in improving dynamic balance.

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APPENDICES

APPENDIX1

ASSESSMENT FORM

Participant Name :

Age / Sex :

Body Weight / Hight/ Kg/ Cm :

College Name :

Medical History :

Recent History :

Previous Injuries :

Recent Surgeries :

Social History :

Personal History :

Pain Assessment :

Side : Right/Left

Site :

Character : Sharp/Dull/Aching/ Throbbing/Radiating

Type of Pain : Constant/Intermittent

Aggravating Factors : Standing / Walking/ Running/Sports

Activities

Relieving Factors :

Vital Signs:

Heart Rate/Mint

Respiratory Rate/ Mint

Blood Pressure (mmHg) On Observation:

Built : Ectomorph/mesomorph/endomorph

Posture :

Deformity :

Muscle Weakness :

Swelling :

Skin Assessment:

Topical Changes :

Texture :

Colour :

On Palpation

Oedema :

Swelling :

Sensory Assessment :

Superficial :

Deep :

Star Excursion Balance Test

S. No	Pre Test			Post Test		
	Anterior	Posteromedial	Posterolateral	Anterior	Posteromedial	Posterolateral

APPENDIX 2

PATIENT INFORMATION & INFORMED CONSENT FORM

Principal Investigator :

Supervisor :

Name of the participant :

Title of the study

“ Comparison of the immediate effect of different types of trunk exercises on the star excursion balance test in male adolescent soccer players”

You are invited to take part in this research study. The information in this document is meant to help you decide whether or not to take part. Please feel free to ask if you have any queries or concerns.

The participation in this research is purely voluntary and you have the right to withdraw from this study at any time during the course of the study without giving any reasons. However, it is advisable that you talk to the research team prior to stopping the treatment.

Principal Investigatior:

Supervisor: Nandha College of Physiyotherapy,

ANNEXURE III

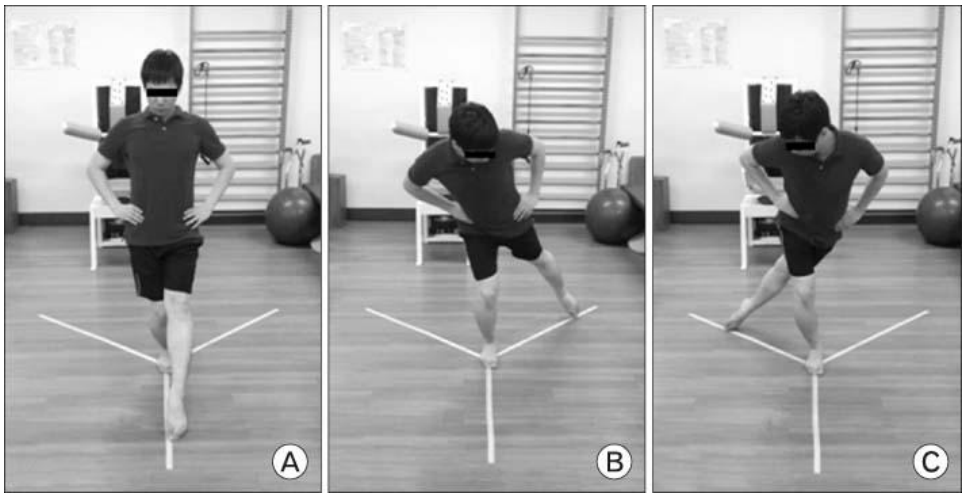
The Star Excursion Balance Test

The participants performed the SEBT in the anterior, posteromedial, and posterolateral directions.29,32-34 They received verbal instruction and visual demonstration of the SEBT from the same examiner before performing the test. The participants stood on the leg they used for kicking a ball, with the most distal part of the great toe placed on the center of the grid. While maintaining a single-leg stance, they used the opposite leg to reach, as far as possible toward the end of the line along a grid in the anterior, posteromedial, and posterolateral directions. Then, they touched the ground lightly with the most distal part of the reaching foot before returning to the starting position. Their hands were held at the iliac crest during the test. All tests were performed barefoot to rule out the influences of shoes. After six practice trials were completed, the participants rested for two minutes and then performed three test trials in each direction.35 The order of the reaching directions was randomized at

each test session. The test was discarded and then repeated in the same manner if a participant failed to maintain the unilateral stance, lifted or moved the standing foot from the grid, or failed to return the

reaching foot to the starting position. The longest reach distance in each direction was used for the analysis. For an accurate analysis, the

data of reach distance was normalized with the leg length to exclude the influence of leg length.25,36 The leg length was measured with a tape measure from the anterior superior iliac spine to the center of the ipsilateral medial malleolus.36 The composite score was calculated according to the formula {(sum of all three directions)/(limb length*3)}*100

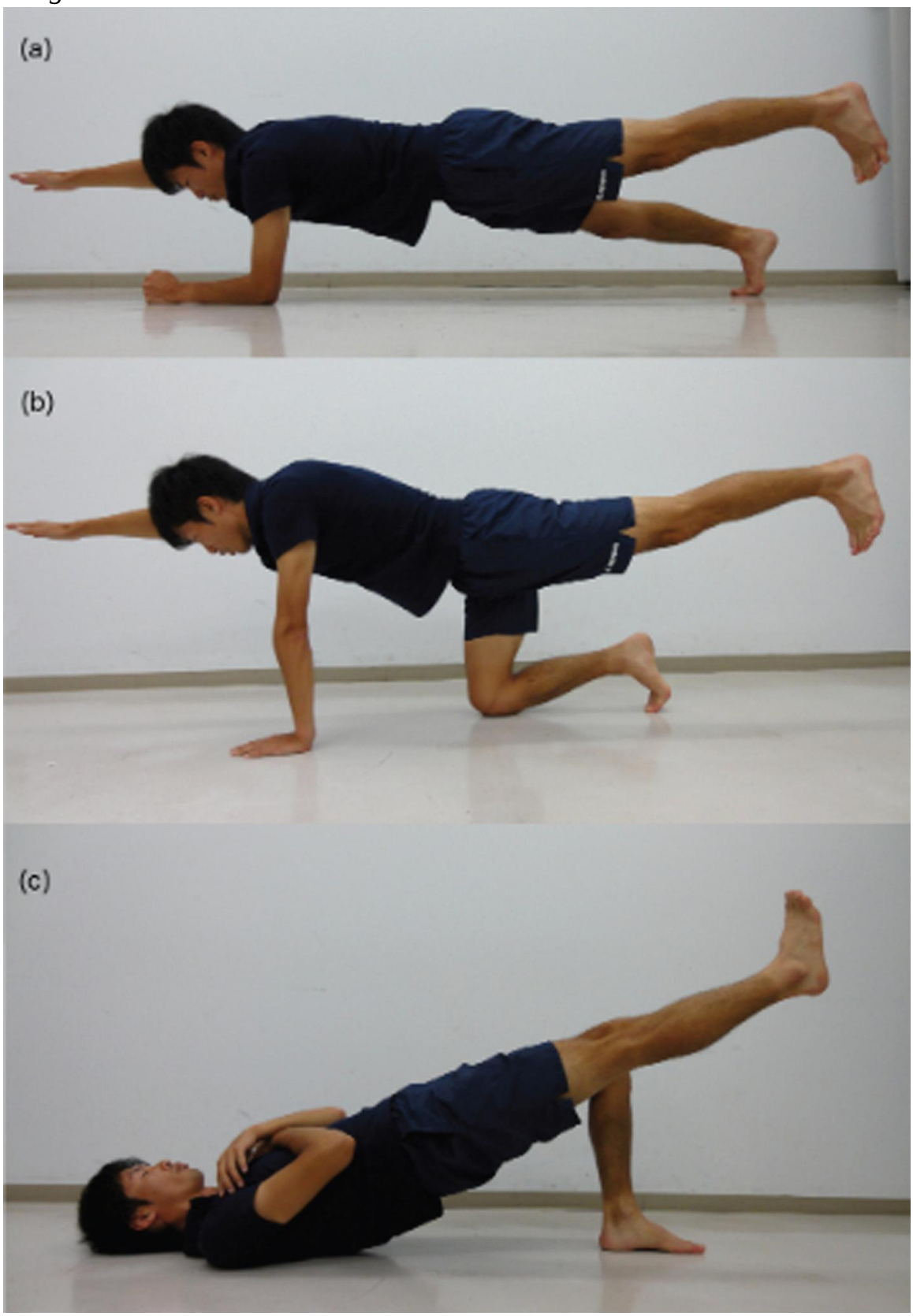


ANNEXURE IV

Trunk stabilization exercise program

The SE program consisted of the front plank, quadruped exercise, and back bridge (Figure 1). Okubo et al37 reported that the SE used in this study involve higher activities of local muscles than other exercises. For the front plank, participants maintained a prone position in which the body weight was supported by the toes and forearms. From this position, they raised the right arm and left leg simultaneously and held them straight up for five seconds. Next, they raised the left arm and right leg simultaneously and held them straight up for five seconds. Then, participants lowered their bodies on the floor and rested for 10 seconds. This routine was repeated five times. For the quadruped exercise, participants assumed a quadruped position. They were then asked to hold a neutral pelvis position and to breathe normally. Then, they raised their right arm and left leg simultaneously and held them straight up for five seconds. Next, they raised their left arm and right leg simultaneously and held them straight up for five seconds. Then, they rested for 10 seconds. This routine was repeated five times. For the back bridge, participants laid supine on the floor, with their feet flat on the ground, knees bent at 90_, toes facing forward and hands folded across the chest. They raised their pelvis to achieve and maintain a neutral hip flexion angle, then raised one leg from the floor and extended the knee straight. This position was maintained for five seconds. Then, they raised the opposite leg and maintained the position for five seconds. Then, they rested for 10 seconds. This routine was repeated five times.

Figure 1. *Trunk stabilization exercise program for this study: (a) the front plank, (b) the quadruped exercise, and (c) the back bridge.*



ANNEXURE V

CONVENTIONAL EXERCISE PROGRAM

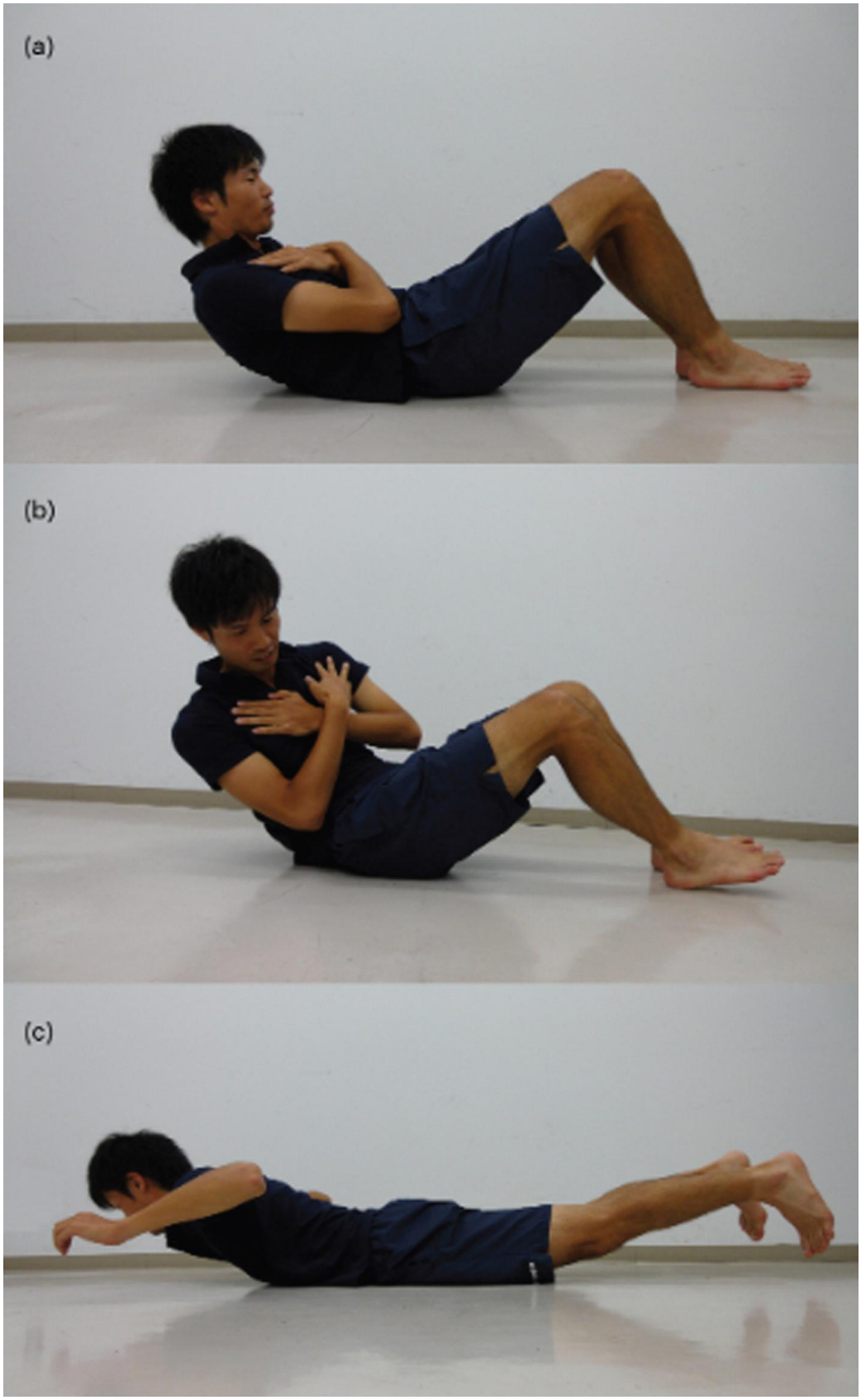
For the CE program, participants performed sit-ups, sit-ups with trunk rotation, and back extensions (Figure 2). For the sit–ups, participants laid supine in the standard sit-up position, knees bent at 90_, and hands folded across the chest with each hand placed

on the opposite shoulder. They were asked to bend and raise the upper body until their elbows reached their thigh and then to return to the starting position. This routine was performed 30 times. For the sit-ups with trunk rotation, participants were asked to raise,

bend, and rotate the upper body to the left or right until the elbow touched the opposite thigh from the starting position of the sit-up. This was performed 30 times, alternating on the right and left sides. For the back extension, the participants lifted their upper body and legs off the floor simultaneously from a prone position on the floor. After a comfortable elevation,

they lowered their upper body and legs to return to the starting prone position. These movements were repeated 50 times.

Figure2. Conventional exercise program for this study.(a) the sit-up the sit-up with trunk rotation,and (c) the back extension



ABSTRACT

Purpose/Background: Trunk exercises, such as trunk stabilization exercises (SE) and conventional trunk exercises (CE), are performed to improve static or dynamic balance. Recently, trunk exercises have also been often used as part of warm-up programs. A few studies have demonstrated the immediate effects of SE and CE on static balance. However, immediate effects on dynamic balance are not yet known. Therefore, the purpose of this study was to compare the immediate effect of SE with that of CE on the Star Excursion Balance Test (SEBT).

Methods: Eleven adolescent male soccer players (17.9 ± 0.3 years, 168.5 ± 5.4 cm, and 60.1 ± 5.1 kg) participated in this study. A crossover design was used, and each participant completed three kinds of testing sessions: SE, CE, and non-exercise (NE). Experiments took place for three weeks with three testing sessions, and a 1-week interval was provided between different conditions. Each testing session consisted of three steps: pretest, intervention, and posttest. To assess dynamic balance, the SEBT score in the anterior, posteromedial, and posterolateral directions was measured before and 5 minutes after each

intervention program. The data of reach distance were normalized with the leg length to exclude the influence of the leg length on the analysis.

Results: The SEBT composite score was significantly improved after the SE ($p < 0.05$) but did not change after the CE and NE ($p > 0.05$). Furthermore, in the SE condition, SEBT scores of the posterolateral and posteromedial directions were significantly improved at the posttest, compared with those at the pretest ($p < 0.05$).

Conclusions: This study demonstrated the immediate improvements in the posteromedial and posterolateral directions of the SEBT only after the SE. This result suggests that the SE used in this study is effective in immediately improving dynamic balance.